recent British engines. An illustration is given of an engine of this type, as well as a full-page engraving of a compound locomotive with a similar boiler. This compound is very different from the Webb or Worsdell engines common in this country, being the design of the superintendent of the Baldwin Locomotive Works. The cylinders are outside the frames—there are two on each side, viz. one high-pressure and one low-pressure. The distribution of the steam being effected in each pair by one piston valve, each pair of pistons is connected to one crosshead, coupled in the usual way to the wheels.

A compound engine of the "Webb" type is also illustrated. This engine was constructed to Mr. Webb's designs in this country for the Pennsylvania Railway in 1889. It is stated that the results of experiments showed a saving of fuel over the ordinary engine of from 20 to 25 per cent.

This book is so full of interesting matter of so varied a nature that it would be possible to prolong this notice far beyond the space available. Take, for instance, agricultural machinery; the Price ploughing outfit is typical of the rest, consisting of a traction engine drawing four gangs of three ploughs, the twelve ploughs cutting eleven feet wide. The subject of milling tools is also of interest, because it is only during the last few years British engineers have used this means of shaping metals, the system having been brought into general use in the States.

Under the head of the manufacture of steel all the usual processes are described. We are informed that the Whitworth compression process is only partly successful in the formation of sound ingots; with this statement we cannot agree; the Whitworth steel ingot after compression is certainly sound throughout.

Taking into consideration the great mass of information contained in the 900 odd pages of this work, and the general excellence of the matter accumulated, it is only just to congratulate the editor on the completion of a work which must prove useful to many, and which should find a place in all technical libraries. The volume goes far to describe modern American mechanism, exhibiting the latest progress in machines, motors, and the transmission of power.

SEEDLINGS.

A Contribution to our Knowledge of Seedlings. By the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S., D.C.L., LL.D., with 684 figures in text. In two volumes. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1892.)

SEEDS and seedlings have occupied the attention of Sir John Lubbock for a somewhat lengthened period. They have formed the subject of various communications, on his part, to the Journal of the Linnean Society and other publications. In the present volumes, modestly styled a "contribution," he gives us the details upon which his inferences have been founded.

The physical and chemical aspects of germination are entirely passed over, but the morphological phenomena are treated with a fulness never before attempted. The author has availed himself of the resources put at his disposal by the authorities at Kew, where the larger proportion of the seedlings described were grown expressly for the purpose. The Natural History Museum and the Cambridge Botanic Gardens have also been requisitioned, and much help has been rendered by capable assistants, whilst the services of Sir Joseph Hooker and Mr. Rendle, in looking over the proof sheets, are duly acknowledged. A work of such dimensions, crowded with detail, could hardly have been produced without such zealous co-operation. Nevertheless unity of plan and uniformity of treatment are conspicuous throughout, and thus comparison is readily effected.

Some previously published papers in the Journal of the Linnean Society, dealing with the causes which determine the form of leaves and cotyledons, are reprinted as the introduction to the treatise. The conclusion therein arrived at is that the form of the embryo, and especially that of the cotyledons, is essentially influenced by the form of the seed. On p. 78 the author begins the detailed examination of seedlings taken from almost all the orders of flowering plants. Five hundred and thirty succeeding pages in the first volume, and five hundred and eighty-eight in the second volume, are thus occupied. This little bit of statistics will serve to show the amount of detail which is contained within these volumes. The plan adopted is to give, first of all, a general sketch of the principal modifications exhibited by the fruit and seed in each order. Then follows a more detailed description of the seed and of the seedling plant in various representatives of the order. As these descriptions are identical in plan throughout, they are of great value to the student of comparative morphology. Naturally some orders are much better represented than others, but sometimes the omissions are rather unfortunate. In the genus Araucaria, for instance, seedling representatives of which are common in botanic gardens and nurseries, the diversities in the form of the seedling and in the mode of germination are very remarkable. "Characters" derived from the seedling plant have been recognized as of the highest importance for classificatory purposes since the time of John Ray (1682-1703).[1]

But whilst this is generally the case, such extraordinary exceptions as that mentioned in Araucaria are very noteworthy, and not less so because the genus in question is one of the very oldest of which fossil botanists have cognizance.

Myrtaceæ and Sapindaceæ are remarkable for the extremely diverse character of the embryo in different genera, and of which due note is taken in Sir John Lubbock's book. In Rosaceæ, on the other hand, the diversity is much less, nor is there any important morphological difference in the seedlings of the great order Compositæ, and scarcely more in Umbelliferæ, so far as they are known. These are facts of great significance with reference to the theories of inheritance and relative antiquity of groups.

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[1] It may not be without interest to cite what Ray says on this matter:—"Floriferas dividemus in *dicotyledones* quarum semina sata binis foliis anomalis, seminalibus dictis, quæ cotyledonum usum præstant, e terra exeunt vel in binos saltem lobos dividuntur, quamvis eos supra terram foliorum specie non efferant; et *monocotyledones* quæ nec folia seminalia bina efferunt nec lobos binos condunt." Thus Ray not only recognized the presence of one or of two cotyledons, but also their nature and their epi- or hypogeal condition. As Ray has been mentioned, it is certainly not inappropriate to allude to Grew also, for the first chapter of his "Anatomy of Plants" (1682), and the whole of the fourth book is devoted to the seeds and seedlings and in perusing them the reader will perceive that Sir John Lubbock has in a few cases been anticipated by his celebrated predecessor.

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The gradual evolution of the perfect plant from the seedling is indeed a subject of great interest to the phylogenist, although it is difficult—nay, impossible—to separate those appearances which are merely hereditary from those which are the result of varying outward conditions, the more so because analogous conditions must have influenced the ancestors in past times even as they affect their successors now.

Amid such a mass of detail it is difficult to pick out points worthy of special note. We select two only out of many scores that might be mentioned. Some Onagrads are remarkable for the intercalary growth which takes place in the cotyledons, of which several illustrations are given in Sir John Lubbock's book. They call to mind the experiments of the late Prof. Dickie, who, by suppressing the plumule of seedling castor-oil plants, succeeded in inducing the cotyledons to continue their growth and to assume dimensions much greater than that which is habitual to them.

The small tubercles on the root of *Myrica californica* (vol. ii. p. 523, Fig. 663) have, so far as we know, not previously been observed. The author compares them to those found on *Alnus cordifolia*, and it would be interesting to ascertain whether these outgrowths are caused by an organism analogous to *Schinzia alni*, as described by Woronin, or to that which induces the peculiar tubercles on the roots of Leguminosæ, recently studied by Prof. Marshall Ward.

Monocotyledons generally have been rather badly treated by the author, although such genera as Potamogeton, Aponogeton, Orontium, and other Aroids, and Palms (of which not a single illustration is given) would have furnished examples at once interesting and easily accessible.

The work includes nearly seven hundred illustrations, faithfully executed, and very valuable to the student. The bibliography, in spite of its occupying no fewer than thirty-eight pages, is the weak part of the book. Some of the most important references are omitted, and whole series of species whose mode of germination has been recorded and sometimes figured, have been passed over This only shows how colossal has been the task which Sir John Lubbock has set himself. We do not think the worse of the sun for having a few spots on his disc, nor are botanists at all likely to disparage this work because further research might have added a few more illustrations. As it is, it forms one of the most substantial and important contributions to botanical literature that have ever emanated from the press. It must continue to be a standard book of reference for generations, and it will, we hope, stimulate observers, according to their several opportunities, to prepare similar monographs on the various organs of plants.

MAXWELL T. MASTERS.

EPIDEMIC INFLUENZA.

Epidemic Influenza: a Study in Comparative Statistics. By F. A. Dixey, M.A., M.D. (London: Henry Frowde and H. K. Lewis, 1892.)

AFTER an epidemic disease has visited a country, when the pathologist and practical physician have had their say, there still remains the work of the statistician to be done. It is his province to sum up the results of the visitation in the clear light of hard figures, and to trace its onset and decline in mathematical curves. Such work is of value in more than one direction. It preserves for future generations a definite record of an epidemic of greater precision than the impression left on the mind of the physician: it enables a comparison to be drawn between our own experience and that of other countries: by the sifting and sorting of facts which it necessitates it may lead to the discovery of relationships with allied diseases which may prove of no small value to the pathologist.

This work has been done for influenza by Dr. Dixey in a very thorough and painstaking manner from the material collected under the supervision of the Registrar-General. It says much for the completeness of our registration system in London, that it is possible to compile from them such tables and curves as those with which we are presented in this work, nor are such materials available from any other city in Europe. The only cities whose statistics have been found by Dr. Dixey sufficiently accurate for comparison with our own are Paris and Berlin.

Dealing first with the epidemic of 1889–90, he shows in Table 1 the rise and progress of the disease in London, as indicated by the weekly returns of fatal cases, grouped according to the seven age periods adopted in the official returns. Table 2 gives us, so far as the returns of the period permit, the similar figures for the epidemic of 1847–48. The similar characters of the two epidemics are strikingly illustrated: in both we see the same extreme suddenness of rise, and the same features of decline, rapid at first, but becoming gradually slower during the succeeding months. In the next two tables are included similar figures for Paris and Berlin, and in these, and in Table 5, the author gives an analysis of the meteorological conditions accompanying the rise and fall of the epidemic in the three cities. These are of interest as showing how little influence the weather had on the course of the disease as a whole.

In the tables which follow—which are perhaps of greater interest than any of the others Dr. Dixey has compiled—the effects which influenza has exerted on the mortality from other diseases in London and other cities are shown. These effects are of two kinds: influenza may aggravate the mortality of pre-existent disease such as phthisis or heart disease, or diseases such as bronchitis or pneumonia may occur as complications of influenza and swell its death-roll. It is interesting to observe that whereas in 1847–48, which was in all respects a more fatal epidemic than that through which we have just passed, bronchitis showed the most extreme departure from the normal mortality, pneumonia holds that place in the late epidemic, while bronchitis falls into the second rank. In this connection may be mentioned a point of much interest illustrated in Tables 10, 11, and 12, which deal with the age incidence of influenza and its concomitant diseases. It is possible to draw curves showing the special age incidence of each, and each curve has its own special features. Now during an influenza epidemic the pneumonia curve is found to be modified so as to take on some of the characters of the influenza curve, thus affording corroborative evidence of a conclusion already reached both in this country and in

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